KING COUNTY CONVEYANCE SYSTEM IMPROVEMENT PROJECT

MILL CREEK / GREEN RIVER SUBREGIONAL PLANNING AREA

FINAL TASK 250 SUPPLEMENT REPORT

KENT AND AUBURN PLANNING ZONES

JUNE 2001

HDR

In Association with

Herrera Environmental Consultants, Inc.

Note:
Some pages in this document have been purposefully skipped or blank pages inserted so that this document will copy correctly when duplexed.

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FIGURES

INTRODUCTION

The Conveyance System Improvements Project (CSI) is a comprehensive evaluation of the county conveyance system and an assessment of requirements to transport flows projected to the year 2050. General alternatives for additional capacity in the Mill Creek/Green River Subregional Planning Area (MC/GR) were identified and subsequently developed into working alternatives. The work progress and results were reported in Task reports 210 through 250 for the MC/GR.

Wastewater flow projections by decade to year 2050 were developed for the MC/GR and presented in the Task 240 report. The flow projections were distributed throughout the MC/GR to specific areas called Flow Projection Areas (FPAs), which conform to local agency collection systems. Using the King County hydraulic model, the flow was then routed into the King County conveyance system to determine future adequacy or lack of capacity. Based on these results, alternatives for providing the required conveyance capacity were developed. For purposes of organizing results and describing alternatives, the MC/GR was divided into three planning zones: Kent, Auburn, and Soos, as shown in Figure 250S-1.

The alternatives developed in Task 240 were defined to planning level for the purpose of comparative evaluation. Initial definition of alternatives included pipe size; general alignment; and recognition of significant features such as roadways, railroads, streams, and wetlands, etc. Comparative evaluation of alternatives was presented in the Task 250 report. The primary basis for comparison was cost, which was prepared from the Task 250 cost model. Pipe size estimates were used for selecting construction cost unit prices. However, the alternatives were not detailed to the extent that a specific project budget could be identified. The potential impact of infiltration and inflow (I/I) reduction on alternative design and cost was also evaluated and presented in the Task 250 report.

Additional development and evaluation of the most advantageous alternatives in the Kent and Auburn planning zones was completed and is presented in this supplement to the Task 250 report. This additional work optimizes the hydraulic capacity of the proposed projects and validates or revises alignments and grades to accommodate critical service elevations and physical constraints. Alignment improvements were developed based on existing construction corridors and opportunities to minimize impacts on the public and existing improvements. An additional Task 250 supplemental report will provide additional detail for the Soos Planning Zone

Construction estimates were prepared for the general alternatives developed in the MC/GR Task 250 report using the tables presented in the draft Task 250 report on conveyance system cost estimates. The tables presented in that report are based on a fixed average condition for varying pipe diameter and are derived from an extensive cost model spreadsheet that develops cost for a variety of construction scenarios. The cost model spreadsheet allows specific conditions including depth and unit material prices to be factored into a specific unit price for a constructed facility. The cost estimates presented in this Task 250 Supplement were developed for specific projects using the updated cost model Tabula, developed for the CSI project. These cost estimates are included in Appendix A. Generally, the higher construction costs presented in this supplement are the product of more specific determinations of pipeline depth, methods of construction, and local conditions. Pipeline cost has been assumed to include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. Total project cost is estimated from King County's budget model. Final predesign studies may find certain elements over-estimated

while others are under estimates. The supplement estimates are conservative and subject to some reduction by refinement during predesign. Construction cost is estimated to year 2001 dollars. Final project estimates should be escalated to year of construction. Table 250S-1 presents project costs for each planning zone.

Table 250S-1. Construction Cost Estimates for MC/GR Working Alternatives

Working Alternative	Estimated Construction Cost [a] (million dollars)	Total Project Cost (million dollars)
Auburn Planning Zone		
Southwest Interceptor	$32.8	$67.1
26th Street Trunk	$2.1	$4.6
Stuck River Trunk	$9.2	$19.7
	Auburn Planning Zone Total	**$91.4**
Kent Planning Zone		
Garrison Creek Relief Trunk	$12.4	$26.6
James Trunk	$4.4	$9.5
Meeker Trunk	$2.6	$5.5
Southwest Interceptor	$41.7	$85.1
	Kent Planning Zone Total	**$126.7**
	Total Estimated Cost	**$218.1**

[a] Cost estimate based on CSI cost model version 0.6.2 (2001 dollars)

General plan and profile sheets are presented at the end of each project discussion to document the refined projects and provide a basis for refinement of the cost estimates provided in the Task 250 report. These project refinements are presented as working alternatives, subject to further decisions and revision at the time of project implementation. Design issues and constraints that will impact project implementation are also described.

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Figure 250S-1. Working Alternatives Kent, Auburn, and Soos Planning Zones

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SOUTHWEST INTERCEPTOR
KENT AND AUBURN PLANNING ZONES

The new Southwest Interceptor consists of approximately ten miles of sewer construction generally located within the West Valley Highway right-of-way.

WORKING ALTERNATIVE DESCRIPTION

Figure 250S-2 shows the working alternative for the Southwest Interceptor; existing King County sewers; the MC/GR boundary; and the Auburn, Kent, and Soos planning zones. Points A through H in the figure are used in the text and graphics to describe the alignments for the working alternative.

The Southwest Interceptor working alternative redirects flow from the Auburn Interceptor (Sections 1, 2, and 3), Auburn West Valley Interceptor, Auburn West Interceptor, and M Street Trunk easterly to the Southwest Interceptor in the West Valley Highway. The Southwest Interceptor serves the southernmost basins of the MC/GR, as well as providing relief to the Auburn Interceptor through several diversions. The only area not directly served by this interceptor is located east of the Auburn (1) Interceptor and north of James Street in Kent. That area will continue to be served by the Garrison Creek Relief Trunk, Mill Creek, and Auburn (1) Interceptors.

Other potential routes were considered. The hydraulic flow routing model eliminated most routes, and planning level field inspection eliminated the rest of the variations that had been considered. Extensive wetland areas adjacent to SR 167 limited the feasibility of an alignment in that right-of-way.

The proposed Southwest Interceptor begins with a 27 inch diameter sewer to carry a design flow rate of 5.5 million gallons per day (mgd), which is connected to the downstream end of the Pacific Pump Station forcemain at Tacoma Boulevard and 3rd Avenue South (point A) in Algona. It is routed east to Algona Boulevard and north to 11th Avenue North, where it picks up approximately 28.4 mgd from the east (point B). Flow from the east is diverted from the West Valley, West, and M Street interceptors. At that point the diameter is increased to 54 inches, and flow is routed west under SR 167 and north on West Valley Highway. The 54 inch sewer continues north with a design capacity of 42.3 mgd to about 29th Street Northwest (point C). At that point there is a 54 inch diameter intertie that routes the majority of flow (±31.7 mgd) east to the existing Auburn Interceptor to make use of its available capacity. A 36 inch diameter sewer with a design flow rate of 13.6 mgd continues north on West Valley Highway to South 277th Street (point D).

The available grade between point D and the Green River siphon to the north is inadequate to carry the combined projected flow for the Southwest Interceptor, the Auburn Interceptor, and the South 277th Interceptor, unless two parallel 72-inch diameter pipes are constructed. The Southwest Interceptor working alternative uses a single 72-inch diameter sewer to convey flow to a new siphon.

At South 277th Street, the South 277th Interceptor flows into the Auburn Interceptor, and approximately 45.3 mgd of the combined projected flow is diverted west to the Southwest Interceptor through a 60 inch intertie at point D. The Southwest Interceptor then continues north with a 72 inch diameter sewer at a very flat slope. Construction of a siphon under the Green River in Kent is required at point E; a 1.5 foot vertical drop in grade is allowed across the siphon. At Meeker Street in Kent, about 6.2 mgd from the West Hill Interceptor must be diverted to the Southwest Interceptor to reduce excessive flow in the West Hill, ULID 1/4, and ULID250 interceptors.

At James Street in Kent, flow is diverted from the Mill Creek and Garrison Creek Relief Trunk to the Auburn Interceptor. An intertie with the Southwest Interceptor is also proposed at this point. A 42-inch intertie at James Street (G) diverts about 16.2 mgd from the Auburn Interceptor, and the diameter is increased to 78 inches.

The downstream end of the Southwest Interceptor connects to the existing King County system where the 108 inch diameter South Interceptor joins the Kent Cross Valley Interceptor and the Auburn (1) Interceptor at manhole AUB1.R18H-01 (point H). The Southwest Interceptor is elevated to match the pipe crown of the South Interceptor. Flow from point H will be distributed to the newer 108-inch diameter South Interceptor and the existing 72 inch ULID1/2 Interceptor (via the Kent Cross Valley Interceptor) depending on final pipe elevation or use of weirs. Analysis of system performance to the north, including flow contributions from the North Green River Subregional Planning Area, may suggest a more specific distribution of flow to either sewer.

Interties at 29th Street NW (point C) and South 277th Street (point D), allow construction of the 7,700 foot section of the Southwest Interceptor between the interties to be delayed until 2020. Flow is diverted to the Auburn Interceptor to make use of existing capacity there. A 36 inch diameter sewer, constructed in 2020, would be adequate through that section. A 54 inch sewer is required between points C and D if the 29th Street Intertie is not constructed. Planning level analysis of the effects of an inflow and infiltration (I/I) reduction program indicate that this section may not be required if the I/I reduction is effective and timely. Construction cost estimates for the 29th Street NW intertie is about $2.6 million and the 36-inch sewer is about $6.1 million.

An alternative to the proposed project would eliminate the 29th Street NW intertie and construct a 54-inch diameter sewer between points C and D. Estimated cost for construction 54 inch sewer is about $8.9 million. Use of a 54 inch pipe in the area should be considered regardless of the construction of the 29th Street Intertie because the capacity of the section of pipeline may be exceeded in the future. Replacement of the pipeline will likely be very costly as this area becomes more densely developed.

The South 277th Street intertie at point D is required in either configuration.

The photographs and text provided below show existing views looking downstream from intervals along the proposed alignment, starting from the upstream end. In all other projects, a symbol on the figure indicates placement and direction of photographs. This was not done for the Southwest Interceptor due to limited room on the graphic. Water lines, sewers, power, and telephone utilities were evident in all rights-of-way along the alignment, unless noted under the photo. Preliminary plan and profile sheets at the end of this project discussion show the Southwest Interceptor working alternative with proposed diameters, interties, and connection points, using 1997 aerial photos for the plan view.

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Figure 250S-2. Southwest Interceptor Working Alternative

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Southwest Interceptor Working Alternative from A to B

1. (A) View west on 3rd Avenue South at Tacoma Boulevard South from beginning connection point at existing manhole ALPAC 238. Stormwater is conveyed by ditches. The alignment crosses a public trail. Access to homes must be maintained

2. View north on Algona Boulevard South at 3rd Avenue South. Stormwater is conveyed by ditches. Access to homes must be maintained

3. View north on Algona Boulevard North at Main Street. Power and telephone lines are underground through this section. Access to homes must be maintained.

4. View northwest on Algona Boulevard North at 7th Avenue North. Access to homes must be maintained.

5. View west on 11th Avenue North at Algona Boulevard North. Micro-tunneling is required to cross SR167. There is a large ditch/wetland area next to the highway that is shown on the map as an unnamed creek. Access to homes must be maintained.

6. View west on 11th Avenue North at SR 167. Access to businesses must be maintained.

Southwest Interceptor Working Alternative from B to C

7. (B) View north on West Valley Highway at 11th Avenue North. Stormwater is conveyed by ditches and there is a wide shoulder through this section. Access to businesses must be maintained.

8. View north on West Valley Highway north of the curve at 15th Street Southwest. Stormwater is conveyed by ditches and there is a narrow shoulder through this section. At SR18 the alignment crosses on unnamed creek that is apparently piped at that point

9. View north on West Valley Highway south of the curve at West Main Street. Stormwater is conveyed by ditches and there is a wide shoulder through this section. Mill Creek parallels the alignment in the property to the east.

10. View north on West Valley Highway south of 15th Street Northwest. Roadway widens prior to the intersection and sidewalk begins. Access to business must be maintained.

Southwest Interceptor Working Alternative from C to D

11. (C) View north on West Valley Highway at 29th Street Northwest. North of the curve, the alignment crosses a tributary of Mill Creek, the sidewalk ends and the roadway narrows. Access to businesses must be maintained.

12. View north on West Valley Highway north of 37th Street Northwest. Stormwater is conveyed by ditches and there is a narrow shoulder through this section. Access to businesses must be maintained.

Southwest Interceptor Working Alternative from D to E

13. **(D)** View north on West Valley Highway at South 277th Street. The alignment crosses Mill Creek twice. Stormwater is conveyed by ditches and there is a narrow shoulder through this section. Access to homes and businesses must be maintained.

Southwest Interceptor Working Alternative from E to F

14. **(E)** View north on West Valley Highway at ±200 feet south of the Green River. A siphon is required to cross the river at the high point of the road in the picture. Access to business and homes must be maintained.

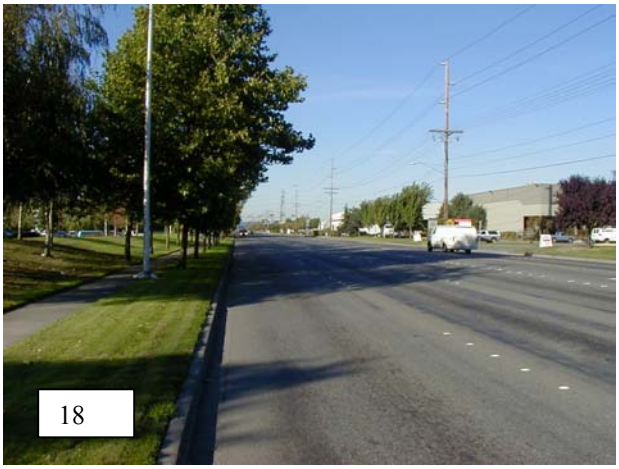
15. **(E)** View northwest on West Valley Highway at ±40 feet south of the Green River.

16. View north on West Valley Highway south of Des Moines Road South (a.k.a. SR-516/West Wellis Street). Access to businesses must be maintained

Southwest Interceptor Working Alternative from F to G

17. **(F)** View north on West Valley Highway (a.k.a. Washington Avenue/68th Avenue South) at West Meeker Street. Access to businesses must be maintained.

Southwest Interceptor Working Alternative from G to H



18. **(G)** View north on West Valley Highway (a.k.a. 68th Avenue South) at South 228th Street. Access to businesses must be maintained

19. View north on West Valley Highway at South 216th Street. The creek crossing in this section is shown on the next graphic. Access to businesses must be maintained.

20. View northwest on West Valley Highway south of South 216th Street. Bridge crossing tributary of Springbrook Creek on West Valley Highway

21. South 216th Street at 72nd Avenue South. Manholes AUB1.R18H-01, KENTX.R18G-01A, and KENTX.R18G-02 in the intersection where Southwest, Auburn, South, and Kent Cross Valley interceptors converge. Access to businesses must be maintained.

OPERATION AND MAINTENANCE

The proposed Southwest Interceptor project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary. The final design should achieve adequate scouring velocities to prevent solids deposition in the pipeline. Grade is available to develop velocities of at least 2 feet per second in all sections, even with initial low flows. Intertie connections will include weirs to facilitate operation of the system for optimum performance.

DESIGN ISSUES AND CONSTRAINTS

Flow projections were routed using a hydraulic model specific to the MC/GR and distributed between the existing interceptors and the proposed Southwest Interceptor. Interties were added to the design to optimize use of the existing interceptors, and to delay construction of a portion of the Southwest Interceptor pending success of I/I reduction efforts.

Figures 250S-3 and 250S-4 show the existing and proposed design capacities of the interceptors, their diameters, and allocation of the 2050 projected flow. The existing interceptors include, from south to north, Algona-Pacific, Auburn West Valley, and Auburn Interceptor (Sections 1, 2, and 3). Some sections of existing sewer will have capacities less than the 2050 flow projection even after the proposed improvements are completed. These sections include pipes with negative slope recorded on as-built drawings and a few short sections of pipe with minimal backwater effect at the design flow rate. Predesign studies should evaluate backwater effect and determine whether additional work is required at these locations.

There are several hydraulic constraints. The sewer is approximately ten miles long, and the average slope between the connection points at the north and south ends is very flat. The invert and crown elevations of existing sewers at intertie locations control the elevation and achievable slope of specific sections of the Southwest Interceptor.

The elevation of the existing siphon across the Green River is too high to be incorporated in the grade of the Southwest Interceptor so a new siphon is proposed. Siphons require adequate drop to develop and maintain scouring velocities. As-built drawings for the existing siphons show about 1.16 foot drop across the inverted siphon which consist of 18 , 42 , and 54 inch diameter pipe to provide approximately 150 mgd capacity. A 1.5 foot drop has been allowed for the Southwest Interceptor inverted siphon which must provide about 57 mgd capacity. Pre-design reports should refine design of the siphon based on high and low flow and evaluate construction methods and geotechnical conditions.

Micro-tunneling is required to cross SR 167 and SR 18 near their intersection in Auburn. If trunk depths are equal to or greater than about 25 feet, obtaining geotechnical information and groundwater level data is warranted. Depending on data obtained from these investigations, alternative forms of construction may be required.

EASEMENT AND PROPERTY REQUIREMENTS

Proposed alignments are within existing street rights-of-way. Additional easements for construction may be required at the Green River, SR 167, and SR 18 crossings.

PROJECT IMPACTS

Typical temporary construction related impacts associated with the Southwest Interceptor working alternative will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Environmental impacts can be significantly reduced by keeping the alignment within existing roadways and including adequate erosion control measures. Impacts on traffic can be reduced by scheduling construction work around peak traffic flow periods. Impacts to be addressed in predesign include avoiding or relocating utilities and minimizing environmental and public impacts.

Specific project impacts identified for the Southwest Interceptor working alternative are summarized in Table 250S-2. Planning level field investigations were performed to assess existing conditions along proposed alignments. Utility location and type were noted, in addition to potential easement requirements and possible environmental impacts.

Table 250S-2. Southwest Interceptor Working Alternative Existing Conditions

	Observed Conflicts [a]												Roadway Type [b]				Traffic Lanes	
Working Alternatives	Railroad Xing	Creeks/River Xing	OHT	UGT	Water	Sewer	Storm Drain	Gas	OHP	UGP	Sidewalk	Street Trees	Primary Arterial	Minor Arterial	Collector	Local	2	4+
A to B																		
Tacoma Blvd/3rd Av S- WEST			x		x	x	x		x		x					x	x	
3rd Av S/Algona Blvd - NORTH			x		x	x	x		x		x	x			x		x	
Algona Blvd/11th Av N - WEST		x	x		x	x	x		x		x					x	x	
B to C																		
W Valley Hwy/11th Av N - NORTH		x	x	x	x	x	x		x	x	x			x	x		x	
C to D																		
W Valley Hwy/29th St NW - NORTH		x	x	x	x	x			x		x			x	x		x	
W Valley Hwy/37th St NW - NORTH			x	x	x	x			x				x	x	x		x	
D to E																		
W Valley Hwy/S 277th St - NORTH		x	x		x	x			x						x		x	
E to F																		
W Valley Hwy/Green River - NORTH		x	x		x	x			x				x		x		x	
F to G																		
W Valley Hwy/W Meeker St - NORTH			x	x	x	x	x		x	x	x		x					x
G to H																		
W Valley Hwy/W James St - NORTH		x		x	x	x	x			x	x		x					x
W Valley Hwy/S 216th St - EAST					x	x	x			x						x	x	

[a] OHT (P) Overhead Telephone (Power); UGT (P) Underground Telephone (Power)
[b] From King County GIS data.

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Figure 250S-3. Existing Auburn (1, 2, 3), West Valley, & Algona-Pacific Interceptors: Existing Capacity and 2050 Distributed Flow Projection

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Figure 250S-4. Proposed Southwest Interceptor Design Capacity and 2050 Distributed Flow Projection

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PERMIT REQUIREMENTS

City of Kent and City of Auburn construction permits are required. A shoreline substantial development permit is required at the Green River crossing. The discharge from dewatering options may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge permit. A State Environmental Policy Act (SEPA) checklist is required. Washington State Department of Transportation permission is required to cross SR 18 and SR 167.

PRELIMINARY COST ESTIMATE

Table 250S-3 shows construction cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to some reduction by refinement during predesign.

The construction cost estimate for the Southwest Interceptor is approximately $74.4 million to construct approximately ten miles of sewer. This estimate includes cost for proposed sewer pipe, including interties to the existing system, tunneling under SR 18 and SR 167, tunneling to construct the Green River siphon, and additional cost for deep sewers.

Table 250S-3. Construction Cost Estimates Southwest Interceptor Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Auburn Planning Zone				
Pipeline (Open Cut Construction)				
27 inch	18	7,000	LF	$4,106,716
36 inch	21	7,724	LF	$6,094,833
54 inch	21	18,448	LF	$21,192,820
Pipeline (Microtunnel)				
54 inch	18	1	LS	$1,451,939
Total Construction Cost, Auburn				**$32,846,000**
Kent Planning Zone				
Pipeline (Open Cut Construction)				
42 inch	15	700	LF	$530,037
60 inch	12	1,810	LF	$2,704,969
72 inch	19	11,910	LF	$19,189,502
78 inch	23	9,360	LF	$17,558,301
Pipeline (Microtunnel)				
60 inch	15	1	LS	$1,169,645
18 inch siphon	20	200	LF	$87,233
42/54 inch siphons/structures	20	–	LS	$423,914
Total Construction Cost, Kent				**$41,664,000**
Total Construction Cost, Kent and Auburn				**$74,510,000**

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars).

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SOUTHWEST INTERCEPTOR PLAN AND PROFILE SHEETS

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MINOR PROJECTS—KENT PLANNING ZONE

This section presents working alternatives for required King County conveyance system improvements within the Kent planning zone, except the Southwest Interceptor. Figure 250S-1 shows the working alternatives and options for the Kent planning zone.

MEEKER TRUNK

WORKING ALTERNATIVE DESCRIPTION

Under the Task 240 report rerouting alternative, the proposed Meeker Street Trunk as shown in (Figure 250S-5), provides capacity for projected flows for upstream basins through year 2050.

Currently, flow is conveyed in the West Hill Interceptor to the ULID 1/4 Interceptor, then the ULID 250 (S) Interceptor, the Kent Valley Interceptor, and on to the ULID 1/2 Interceptor. The Meeker Trunk working alternative redirects flow from the West Hill Interceptor, after crossing the Green River, east on W Meeker Street from manhole WHILL.06B to the proposed Southwest Interceptor at the intersection of West Valley Highway and W Meeker Street. The projected 2050 flow is 6.2 mgd. The proposed Meeker Trunk is a 24 inch diameter sewer with a design capacity of 7.9 mgd.

The following photographs depict existing conditions along the proposed Meeker Trunk alignment. The location of each photo is indicated in Figure 250S-5. Included is a brief description of access concerns for each representative section of the proposed alignment.

(P1) W Meeker Street – WHILL06B to Russell Road

Access to businesses and parks must be maintained throughout construction.

(P2) W Meeker Street – Russell Road to Southwest Interceptor

Access to businesses must be maintained throughout construction.

W Meeker Street is the best available roadway for routing the trunk alignment. There are no other roadways near the upstream intertie, and W Meeker Street is the most direct route to convey flows to the Southwest Interceptor. As a result, no option is proposed for the Meeker Trunk alignment.

The Meeker Trunk working alternative is shown on the preliminary plan and profile sheets at the end of this project discussion.

OPERATION AND MAINTENANCE

This project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary. The final design should achieve adequate scouring velocities. Grade is available to develop velocities of at least 2 feet per second.

DESIGN ISSUES AND CONSTRAINTS

Constraints to be considered during design include connection to the existing sewer, and avoiding or relocating existing utilities. Provisions must be in place to provide access to residences and businesses throughout the construction period, and to facilitate movement of traffic.

Critical elevations for the proposed alternative are the upstream intertie at manhole WHILL.06B of the West Hill Interceptor, and the downstream intertie to the proposed Southwest Interceptor at a manhole located at the intersection of West Valley Highway and W Meeker Street. The Meeker Trunk will match crowns at all manholes.

EASEMENT AND PROPERTY REQUIREMENTS

No easement or property acquisitions are anticipated to be required for the Meeker Trunk working alternative. The alignment is located within public rights-of-way. Additional easements for construction may be required where noted on the plan and profile provided at the end of this project discussion.

PROJECT IMPACTS

Typical temporary construction related impacts will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Impacts on the public, businesses, and the environment are of concern with trunk alignments. Access to neighboring residences and businesses must be maintained throughout construction. Impacts on traffic are expected.

Table 250-4 lists existing utilities and roadway descriptions observed during planning level field inspection.

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Figure 250S-5. Meeker Trunk Working Alternative

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Table 250S-4. Meeker Trunk Working Alternative Existing Conditions

	Observed Conflicts														Roadway Type				Traffic Lanes			Parking Lanes	
	Railroad Xing	Creeks/River Xing	OHT	UGT	Water	Sewer	Storm Drain	Gas	OHP	UGP	Bike Lane	Railroad	Bus	Sidewalk	Street Trees	Primary Arterial	Minor Arterial	Collector	Local	1	2	3	1	2
Working Alternative																								
W Meeker Street – WHILL06B to Russell Road			x		x	x	x		x	x			x	x	x	x						x		
W Meeker Street – Russell Road to Southwest Trunk			x		x	x	x		x	x			x	x	x	x						x		

OHT (P) Overhead Telephone (Power); UGT (P) Underground Telephone (Power)
** From King County GIS data.

PERMIT REQUIREMENTS

City of Kent construction permits are required. The discharge from dewatering operations may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge Permit. A State Environmental Policy Act (SEPA) checklist is required.

CONSTRUCTION COST ESTIMATE

Table 250S-5 shows construction and project cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to some reduction by refinement during predesign. The construction cost estimate for the Meeker Trunk is approximately $2.6 million.

Table 250S-5. Construction Cost Estimates Meeker Trunk Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Kent Planning Zone - Meeker Trunk				
Pipeline (Open Cut Construction) 24 inch	16	4,379	LF	$2,568,900
		Meeker Trunk Total		$2,569,000

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars).

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MEEKER TRUNK PLAN AND PROFILE SHEETS

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JAMES TRUNK

WORKING ALTERNATIVE DESCRIPTION

Under the Task 240 report rerouting alternative, the proposed James Trunk (Figure 250S-6), provides adequate capacity for the projected flows for upstream basins through the year 2050.

Currently, flow is conveyed in the Mill Creek Interceptor to the ULID 1/5 Interceptor and on to the ULID 1/2 Interceptor. The James Trunk working alternative redirects the flow in the Mill Creek Interceptor west on W James Street from manhole MILL.18F-06 to manhole AUBURN1.R18H-19 of the Auburn (1) Interceptor. The projected 2050 flow is 16.7 mgd. The proposed James Trunk is a 36-inch diameter sewer with a design capacity of 17.9 mgd.

The following photos depict existing conditions along the proposed James Trunk. The location of each picture is indicated in Figure 250S-6. Included is a brief description of access concerns for each representative section of the alignment.

(P1) W James Street – MILL.R18F- 06 to AUBURN1.R18H-19

Access to an elementary school must be maintained.

W James Street is the best available roadway for routing the trunk alignment. Because W James Street is the most direct route to convey flows to the Auburn Interceptor, no alignment variation option exists for the W James Street trunk alignment.

The proposed James Trunk working alternative is shown on the preliminary plan and profile sheets at the end of this project discussion.

OPERATION AND MAINTENANCE

This project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary. The final design should achieve adequate scouring velocities. Grade is available to develop velocities of at least 2 feet per second.

DESIGN ISSUES AND CONSTRAINTS

Constraints to be resolved during design include connection to the existing sewer, and avoiding or relocating existing utilities. Provisions must be in place to provide access to residences and businesses throughout construction and to facilitate movement of traffic.

Significant design constraints exist for the James Trunk in the form of two railroad crossings. These crossings will require alternative forms of construction such as microtunneling. Microtunneling requires the use of jacking and receiving pits that require a significant area for construction. There appears to be adequate room for these pits on either side of both railroad crossings.

Critical elevations for this alternative are the upstream intertie at manhole MILL18F-06 of the Mill Creek Interceptor, and the downstream intertie at manhole AUBURN1.R18H-19 of the Auburn (1) Interceptor. The James Trunk will match crowns at all manholes.

If trunk depths are equal to or greater than about 25-feet, obtaining geotechnical information on the existing soil conditions in addition to groundwater levels is warranted. Depending on data obtained from these investigations, alternative forms of construction may be required.

EASEMENT AND PROPERTY REQUIREMENTS

The proposed James Trunk is located within public rights-of-way. Permits will be required for railroad crossings. Additional easements for construction may be required where noted on the plan and profile provided at the end of this project discussion.

PROJECT IMPACTS

Typical temporary construction related impacts will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Impacts on citizens, businesses, and the environment are of concern with trunk alignments. Access to neighboring residences and businesses must be maintained throughout construction. Impacts on traffic are expected.

The use of the railroad tracks must be maintained during construction. As a result, open cut construction is not appropriate for the crossing. Microtunneling may serve as a viable solution. It appears that adequate space is available on either side of the roadway for jacking and receiving pits required for this type of construction.

Table 250S-6 lists existing utilities and roadway descriptions observed during planning level field inspection.

PERMIT REQUIREMENTS

City of Kent construction permits are required. The discharge from dewatering operations may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge Permit. A State Environmental Policy Act (EPA) checklist is required.

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Figure 250S-6. James Trunk Working Alternative

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Table 250S-6. James Trunk Working Alternative Existing Conditions

	Observed Conflicts													Roadway Type				Traffic Lanes	Parking Lanes	
Working Alternative	Railroad Xing	Creeks/River Xing	OHT	UGT	Water	Sewer	Storm Drain	Gas	OHP	UGP	Bike Lane	Bus	Sidewalk	Street Trees	Primary Arterial	Minor Arterial	Collector	Local	5	1	2
W James Street SE – MILL.R18F- 06 to AUBURN1.R18H-19	x	x	x		x	x	x		x			x	x				x		x		

*OHT(P) Overhead Telephone (Power); UGT(P) Underground Telephone (Power)
** From King County GIS data.

CONSTRUCTION COST ESTIMATE

Table 250S-7 shows construction cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to overall reduction by refinement during predesign. The construction cost estimate for James Trunk is approximately $4.6 million

Table 250S-7. Construction Cost Estimates James Trunk Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Kent Planning Zone - James Trunk				
Pipeline (Open Cut Construction)				
36 inch	33	3,900	LF	$3,479,956
Pipeline (Microtunnel)				
36 inch	30	1	LS	$934,155
		James Trunk Total		$4,414,000

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars).

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JAMES TRUNK PLAN AND PROFILE SHEETS

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GARRISON CREEK RELIEF TRUNK

WORKING ALTERNATIVE DESCRIPTION

Under the Task 240 report, the proposed Garrison Creek Relief Trunk (Figure 250S-7), provides adequate capacity for the projected flows for upstream basins through year 2050.

Currently, the Garrison Creek and ULID 1/5 trunks serve all of flow projection area (FPA) gar-x. The proposed Garrison Creek Relief Trunk will split the FPA into two parts and redirect a portion of the flow from the western area to the ULID 1/2 Interceptor at manhole ULID1/2.48. The projected flow for this north alignment is 3.2 mgd. This trunk's diameter varies between 15 and 18–inches, and trunk design capacity is 3.3 mgd.

The south alignment diverts the flow from the eastern area of the FPA via W. James Street to the Mill Creek Interceptor at manhole MILL.R18-F.06. Flow is then routed to the Auburn Interceptor via the James Trunk. This alignment of the proposed Garrison Creek Relief Trunk varies in diameter from 15 to 18 inches, and design capacity is 3.9 mgd.

The following photos depict existing conditions along the proposed Garrison Creek Relief Trunk alignment. The location of each picture is indicated in Figure 250S-7. Included is a brief description of access concerns for each representative section of the proposed alignment.

Northern Alignment

(P1) South 222nd Street – 94th Avenue South to 93rd Avenue South

Connection to the existing local sewer occurs in the intersection of South 22nd Street and 94th Avenue South. Access to residences and roadways must be maintained.

(P2) 93rd Avenue South – South 222nd Street to South 218th Street

Access to residences and roadways must be maintained.

(P3) South 218th Street – 93rd Avenue South to 92nd Avenue South

Access to residences and roadways must be maintained

(P4) South 218th Street – 88th Avenue South to 84th Avenue South (east of SR 167)

Alternative forms of construction such as microtunneling will eliminate impacts on SR 167.

(P5) South 218th Street – 88th Avenue South to 84th Avenue South (west of SR 167)

Access to residences, businesses, and roadways must be maintained.

(P6) 84th Avenue South - 218th Street to South 212th Street

Access to businesses and roadways must be maintained.

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Figure 250S-7. Garrison Creek Relief Trunk Working Alternative

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(P7) South 212th Street - 84th Avenue South to 77th Avenue South

Access to businesses and roadways must be maintained

Southern Alignment

(P8) Benson Road - SE 224th Street to SE 236th Street

Access to residences, businesses, and roadways must be maintained.

(P9) SE 236th Street - 104th Avenue SE to 102nd Avenue SE

Access to businesses must be maintained.

(P10) 102nd Avenue SE - SE 236th Street to SE 239th Street

Access to residences and roadways must be maintained

(P11) SE 239th Street – 102nd Avenue SE to 100th Street SE

Access to residences must be maintained

(P12) 100th Street SE – SE 239th Street to James Street SE

Access to residences and roadways must be maintained.

(P13) James Street SE – 100th Street SE to manhole MILL.R18F-06

Access to residences, businesses, and roadways must be maintained

The roadways chosen for the Garrison Creek Relief Trunk are well suited for the trunk alignment. Although there are other roadways that are adequate for trunk alignment, they do not warrant generation of an alignment variation to this working alternative. Several potential alignments were unacceptable due to topography of deep ravines in the area. The working alternative is shown on the preliminary plan and profile sheets at the end of this project discussion.

OPERATION AND MAINTENANCE

This project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary. The final design should achieve adequate scouring velocities. Grade is available to develop velocities of at least 2 feet per second. Several drop manholes are proposed in the north alignment to keep velocities at an acceptable level through the sections with steep grades.

DESIGN ISSUES AND CONSTRAINTS

Constraints to be resolved during design include connection to the existing sewer, and avoiding or relocating existing utilities. Provisions must be in place to provide access to residences and businesses throughout construction and to facilitate movement of traffic.

A design constraint for the Garrison Creek Relief Trunk is a railroad crossing. This crossing will require alternative forms of construction such as microtunneling. Microtunneling requires the use of jacking and receiving pits that require a significant area for construction. There appears to be adequate room for these pits on either side of the railroad crossing.

The proposed upstream intertie for the north alignment delivering flows to the ULID1/2 is at a manhole located at the intersection of South 222nd Street and 94th Avenue South. The downstream intertie point is located at manhole GARISN.R18-11. The second section of pipe connects to manhole GARISN.R18-09. The downstream intertie to the ULID1/2 is located at manhole ULID1/2.48. This portion of the Garrison Creek Relief Trunk will match crowns at all manholes.

The intertie for the south alignment delivering flows to the Mill Creek Interceptor is located at a manhole at the intersection of Benson Road and South 224th Street. The downstream intertie is located at manhole MILL.R18F-06. This manhole is a drop manhole, so the inverts will not be matched.

If trunk depths are equal to or greater than about 25-feet, obtaining geotechnical information on the existing soil conditions in addition and groundwater level data warranted. Depending on data obtained from these investigations, alternative forms of construction may be required.

EASEMENT AND PROPERTY REQUIREMENTS

An easement for a SE 239th Street extension may be required because it provides access to residences and apartments only and is not a through street. All other sections of the proposed Garrison Creek Relief Trunk are located within public rights-of-way. Permits will be required for the railroad crossing. Additional easements for construction may be required where noted on the plan and profile sheets provided at the end of this project discussion.

PROJECT IMPACTS

Typical temporary construction related impacts will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Impacts on citizens, businesses, and the environment are of concern with trunk alignments. Access to neighboring residences and businesses must be maintained throughout construction. Impacts on traffic are expected.

The normal use of the railroad tracks must be maintained during construction. As a result, open cut construction is not appropriate for the crossing. Microtunneling may serve as a viable solution. It appears that adequate space is available on either side of the roadway for tunneling and receiving pits required for this type of construction.

Table 250S-8 lists existing utilities and roadway descriptions observed during planning level field inspection for each alignment.

PERMIT REQUIREMENTS

City of Kent construction permits are required. The discharge from dewatering operations may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge Permit. A State Environmental Policy Act (SEPA) checklist is required.

CONSTRUCTION COST ESTIMATE

Table 250S-9 shows construction cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to reduction by refinement during predesign. The construction cost estimate for the Garrison Creek Relief Trunk is approximately $12.5 million.

Table 250S-8. Garrison Creek Relief Trunk Working Alternative Existing Conditions.

	Observed Conflicts											Roadway Type				Traffic Lanes			Parking Lanes	
Working Alternative	Railroad Xing	Creeks/River Xing	Water	Sewer	Storm Drain	Gas	OHP	UGP	Bike Lanes	UGT	Sidewalk	Primary Arterial	Minor Arterial	Collector	Local	2	5	7	1	2
ULID S 222nd Street – 94th Ave South to 93rd Ave South			x				x								x	x				
93rd Ave South – S 222nd Street to S 218th Street			x				x								x	x				
S 218th Street – 93rd Avenue South to 92nd Avenue South			x	x	x									x		x				
S 218th Street – 88th Avenue South to 84th Avenue South		x												x		x				
84th Avenue South - 218th Street to S 212th Street			x	x	x		x				x	x					x			
S 212th Street - 84th Avenue South to 77th Avenue South	x		x	x	x		x				x	x						x		
Mill Creek Benson Road - SE 224th Street to 104th Ave SE			x	x	x		x				x	x					x			
104th Ave SE - Benson Road to SE 236th Street			x	x	x		x				x	x					x			
SE 236th Street - 104th Ave Se to 102nd Avenue SE				x											x	x				
102nd Avenue SE - SE 236th Street to SE 239th Street			x	x				x		x	x				x	x				
SE 239th Street – 102nd Avenue SE to 100th Street SE			x	x			x								x	x			x	
100th Street SE – SE 239th Street to James Street SE			x	x			x		x					x		x				
James Street SE – 100th Street SE to MILL.R18F-06			x	x	x		x				x	x					x			

*OHT(P) Overhead Telephone (Power); UGT(P) Underground Telephone (Power)
** From King County GIS data.

Table 250S-9. Construction Cost Estimates Garrison Creek Relief Trunk Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Kent Planning Zone - Garrison Creek Relief Trunk				
Pipeline (Open Cut Construction)				
15 inch	16	2,000	LF	$816,016
15 inch	21	4,800	LF	$2,530,745
18 inch	24	7,616	LF	$4,498,008
21 inch	23	6,380	LF	$3,931,233
Pipeline (Microtunnel)				
21 inch	22	1	LS	$631,562
	Garrison Creek Relief Trunk Total			$12,408,000

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars)

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GARRISON CREEK RELIEF TRUNK PLAN AND PROFILE SHEETS

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MINOR PROJECTS—AUBURN PLANNING ZONE

This section presents working alternatives for all required King County conveyance system improvements within the Auburn planning zone, except the Southwest Interceptor. Figure 250S-1 shows the working alternatives and options for the Auburn planning zone.

26TH STREET TRUNK

WORKING ALTERNATIVE DESCRIPTION

Under the Task 240 report rerouting alternative, the proposed 26th Street Trunk, provides adequate capacity for the projected flows from upstream basins through year 2050. Figure 250S-8 shows the 26th Street Trunk working alternative and one alignment variation.

Currently, flow from a ±600-acre flow projection area (FPA) called mst-ne on the east side of the Green River is routed by local sewers to the N Street Trunk at 24th Street NE and M Street NE. The working alternative redirects flow west from Auburn's manhole 410-11 to manhole AUBURN3.R18H-74 of the Auburn (3) Interceptor. The projected 2050 flow is 1.89 mgd. The proposed 26th Street Trunk is an 18-inch diameter sewer with a capacity of 2.7 mgd.

The following photos depict existing conditions along the 26th Street Trunk working alternative. The location of each picture is indicated in Figure 250S-8. Included is a brief description of access concerns for each representative section of the proposed trunk.

(P1) 26th Street NE - M Street NE to K Street NE

Access to the park and an elementary school must be maintained. Connection to the existing sewer is at the intersection of M Street NE and K Street NE.

(P2) K Street NE - 26th Street NE to 28th Street NE

Access to residences and roadways must be maintained

(P3) 28th Street NE - K Street NE to I Street NE

Access to residences, parks, and roadways must be maintained.

(P4) I Street NE - 28th Street NE to 30th Street NE

Access to residences and roadways must be maintained.

(P5) 30th Street NE - I Street NE to C Street NE

Access to roadways and businesses must be maintained.

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Figure 250S-8. 26th Street Trunk Working Alternative and Option

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The working alternative is shown on the preliminary plan and profile sheets at the end of this project discussion.

Working Alternative Variation Description

One alignment variation was evaluated in more detail previously because it was significantly shorter than the working alternative. The variation meets all the requirements of the working alternative but is not considered the best solution for the trunk alignment. The variation redirects flow west from Auburn manhole 410-11 to manhole AUBURN3.R18H-77 of the Auburn (3) Interceptor.

The variation routes the trunk through the Auburn Municipal Airport. This requires alternative methods of construction such as microtunneling. If this is allowed, the length of the trunk can be significantly reduced. However, impacts on the operation of the airport in addition to easement acquisitions must be considered. This section of the variation alignment requires further investigation to determine feasibility.

The following text describes each section of the variation's alignment in lieu of photographs.

26th Street NE - M Street NE to I Street NE

Access to the park and an elementary school must be maintained. Connection to the existing sewer is located at the intersection of M Street NE and K Street NE.

28th Street NE - I Street NE to C Street NE

Access to residences and businesses must be maintained. This alignment includes installation of the trunk in an undeveloped easement shown on the plan and profile sheets for the working alternative (provided at the end of this project discussion). The alignment variation also requires an easement through the Auburn Municipal Airport. Approximately 450 feet of the trunk is located within the runway of the airport.

Operation and Maintenance

This project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary and as indicated by experience. The final design should achieve adequate scouring velocities. Grade is available to develop velocities of at least 2 feet per second.

Design Issues and Constraints

Constraints to be resolved during design include connection to the existing sewer, and avoiding or relocating existing utilities to avoid conflicts. Provisions must be in place to provide access to residences and businesses throughout construction and to facilitate movement of traffic.

Critical elevations for the proposed alternative are the upstream intertie at Auburn's manhole 410-11 of the and the downstream intertie at manhole AUBURN3.R18H-74 of the Auburn (3) Interceptor for the working alternative or manhole AUBURN3.R18H-77 for the variation. The 26th Street Trunk will match crowns at all manholes.

EASEMENT AND PROPERTY REQUIREMENTS

No easement or property acquisitions are anticipated for the 26th Street Trunk working alternative. However, the variation will require an easement through the Auburn Municipal Airport. In addition, an undeveloped right-of-way exists near 26th Place NE. Construction within this undeveloped right-of-way may require additional consideration by the City of Auburn. Additional easements for construction may be required where noted on the plan and profile sheets provided at the end of this project discussion.

PROJECT IMPACTS

Typical temporary construction related impacts will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Impacts on the public, businesses, and the environment are of concern with trunk alignments. Access to neighboring residences and businesses must be maintained throughout construction. Impacts on traffic are expected.

The 26th Street Trunk variation includes a section of the trunk through the Auburn Municipal Airport. Locating jacking and receiving pits away from runways and constructing during early morning or late evening hours can minimize impacts on the operation of the airport.

Table 250S-10 includes existing utilities and roadway descriptions observed during planning level field inspection for each alignment.

Table 250S-10. 26th Street Trunk Working Alternative Existing Conditions

	Observed Conflicts											Roadway Type				Traffic Lanes			Parking Lanes	
Working Alternative	Railroad Xing	Creeks/River Xing	UGT	Water	Sewer	Storm Drain	Gas	OHP	UGP	Sidewalk	Street Trees	Primary Arterial	Minor Arterial	Collector	Local	1	2	4	1	2
26th St - M St to K St			x	x		x		x	x	x				x			x			x
K St - 26th St to 28th St				x	x	x			x	x	x				x		x			x
28th St - K St to I St			x	x	x	x			x	x				x			x			x
I St - 28th St to 30th St			x	x	x	x			x	x			x					x		
30th St - I St to C St			x	x	x	x			x	x				x				x		
Option																				
26th St - M St to I St				x	x	x		x		x	x			x			x			x
26th St - I St to C St				x	x	x		x		x					x	x			x	

*OHT(P) Overhead Telephone (Power); UGT(P) Underground Telephone (Power)
** From King County GIS data.

PERMIT REQUIREMENTS

City of Auburn construction permits are required. The discharge from dewatering operations may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge Permit. A State Environmental Policy Act (SEPA) checklist is required. Additional permits may be required if the alignment variation is chosen for construction under the Auburn Municipal Airport.

CONSTRUCTION COST ESTIMATE

Table 250S-11 shows construction cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to reduction by refinement during predesign. The construction cost estimate for the 26th Street Trunk is approximately $2.1 million.

Table 250S-11. Construction Cost Estimates 26th Street Trunk Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Auburn Planning Zone - 26th Street Trunk				
Pipeline (Open Cut Construction)				
18 inch	16	4,900	LF	$2,148,284
		26th Street Trunk Total		$2,148,000

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars)

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26TH STREET NE PLAN AND PROFILE SHEETS

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STUCK RIVER TRUNK

WORKING ALTERNATIVE DESCRIPTION

Under the Task 240 report rerouting alternative, the proposed Stuck River Trunk, as shown in Figure 250S-9, provides adequate capacity for the projected flows for upstream basins through year 2050.

Currently, flow projection areas (FPAs) mst-s, wi-x, and seg-x are served by the West Interceptor and the M Street Trunk. The working alternative redirects about 70 percent of basin mst-s, 50 percent of basin wi-x, and 100 percent of seg-x to a new trunk called the Southwest Interceptor via the Stuck River Trunk. The working alternative redirects the flow west on 17th Street SE from manhole MSSTRNK.GR19-49 of the M Street Trunk to a manhole of the proposed Southwest Interceptor located on the Algona Boulevard at 11th Avenue North. It interties with the Lakeland Hills Replacement Trunk, the West Interceptor, and the Auburn West Valley Interceptor. The projected 2050 flow is 26.8 mgd. The proposed Stuck River Trunk varies from 30- to 54-inches in diameter, with design capacity of 26.8 mgd.

The following photos depict existing conditions along the proposed Stuck River Trunk. The location of each picture is indicated in Figure 250S-9. Included is a brief description of access concerns for each representative section of the proposed trunk.

(P1) 17th Street SE – J Street SE to A Street SE

Access to an elementary school, churches, residences, businesses, adjacent roadways, and bus lines must be maintained.

(P2) A Street SE – 17th Street SE to 15th Street SW

Access to residences, businesses, and adjacent roadways must be maintained.

(P3) 15th Street SW – A Street SE to C Street SW

Access to the railroad tracks must be maintained.

(P4) 15th Street SW – C Street SW to Industrial Drive SW

This section to be constructed under the Lakeland Hills Replacement Trunk Project.

(P5) Industrial Drive SW - 15th Street SW to Boundary Boulevard

Access to businesses and adjacent roadways must be maintained.

(P6) Boundary Boulevard - Industrial Drive SW to Chicago Avenue

Access to businesses and bus lines must be maintained.

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Figure 250S-9. Stuck River Trunk Working Alternative

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(P7) Chicago Avenue - Boundary Boulevard to 11th Avenue North

Vehicular access likely cannot be maintained due to the limited space available for trunk construction. Access to residences along 11th Avenue North can be maintained via Angola Boulevard North.

(P8) 11th Avenue North – Chicago Avenue to Angola Boulevard North

Access to residences and adjacent roadways must be maintained.

(P9) 11th Avenue North – Angola Boulevard North to Southwest Interceptor

Access to residences and adjacent roadways must be maintained. Construction of the trunk through SR 167 will likely require alternative methods of construction such as microtunneling.

The alignment chosen for the Stuck River Trunk is the best available roadway for routing the trunk alignment. Provisions for an intertie to the Lakeland Hills Replacement Trunk, the Auburn West Interceptor, and the Auburn West Valley Interceptor have been included. Although there are other roadways where the trunk could be routed, they do not warrant generation of an option to the working alternative.

The Stuck River Trunk working alternative is shown on the preliminary plan and profile sheets at the end of this project discussion.

OPERATION AND MAINTENANCE

This project consists entirely of gravity sewers. Maintenance activities should be limited to periodic inspection and flushing as necessary. The final design should achieve adequate scouring velocities. Grade is adequate to develop velocities of at least 2 feet per second.

DESIGN ISSUES AND CONSTRAINTS

Constraints to be resolved during design include connection to the existing sewer, and avoiding or relocating existing utilities to avoid conflicts. Provisions must be in place to provide access to residences and businesses throughout construction and to facilitate movement of traffic.

One design constraint for the Stuck River Trunk is the railroad crossing. This crossing will require alternative forms of construction such as microtunneling. Microtunneling requires jacking and receiving pits. There appears to be adequate room for necessary jacking and receiving pits along 15th Street SE.

Several critical elevations exist for the Stuck River Trunk. Two of the intertie points will be constructed so that diversion can occur at their location in the future. As a result, instead of matching crown elevations at these locations, invert elevations will be matched. These diversion intertie points occur at manhole AUBWVAL 83-16 of the Auburn West Interceptor and at manhole WINT.GR27-39 of the Auburn West Interceptor. Three additional interties exist where crown elevations will be matched. The first is located at the upstream intertie to the M Street Trunk at manhole MSSTRNK.GR19-49. The second is located at the downstream intertie to the proposed Southwest Interceptor located near the intersection of Algona Boulevard North and 11th Avenue North. The third intertie connects to the proposed Lakeland Hills replacement sewer and is located near the intersection of C Street SE and 15th Street SW.

If trunk depths are equal to or greater than about 25-feet, obtaining geotechnical information on the existing soil conditions in addition to groundwater levels is warranted. Depending on data obtained from these investigations, alternative forms of construction may be required.

EASEMENT AND PROPERTY REQUIREMENTS

The proposed sewer line is located within public rights-of-way. Permits will be required for the railroad crossing. Additional easements for construction may be required where noted on the plan and profile provided at the end of this project discussion.

PROJECT IMPACTS

Typical temporary construction related impacts will include increased noise and dust and truck and construction vehicle traffic. Temporary partial road closures may be required. Trees or other vegetation could be impacted by excavations.

Impacts on the public, businesses, and the environment are of concern with trunk alignments. Access to neighboring residences and businesses must be maintained throughout construction. Impacts on traffic are expected.

Table 250S-12 lists existing utilities and roadway descriptions observed during planning level field inspection for each alignment.

Table 250S-12. Stuck River Trunk Working Alternative Existing Conditions

	Observed Conflicts														Roadway Type				Traffic Lanes				Parking Lanes	
Working Alternative	Railroad Xing	Creeks/River Xing	OHT	UGT	Water	Sewer	Storm Drain	Gas	OHP	UGP	Bike Lane	Bus	Sidewalk	Street Trees	Primary Arterial	Minor Arterial	Collector	Local	1	2	4	5	1	2
17th St - J St to A St SE			x		x	x	x		x			x	x				x			x				x
A St - 17th St to 15th St			x		x	x	x		x				x	x	x							x		
15th St - A St to C St	x		x					x	x							x						x		
15th St - C St to Industrial Dr	x		x		x	x	x		x		x		x			x						x		
Industrial Dr - 15th St to Boundary Blvd					x	x	x				x		x				x				x			
Boundary Blvd - Industrial Dr to Chicago Ave				x	x	x	x			x		x	x				x				x			
Chicago Ave - Boundary to 11th						x												x	x					
11th Avenue N - Chicago Avenue to Angola Boulevard N				x	x				x									x	x				x	
11th Avenue N – Angola Boulevard N to Southwest Trunk				x	x				x									x	x				x	

*OHT(P) Overhead Telephone (Power); UGT(P) Underground Telephone (Power)
** From King County GIS data.

PERMIT REQUIREMENTS

City of Auburn construction permits are required. The discharge from dewatering operations may require a section 401 water quality certificate from the Washington Department of Ecology or a King County Industrial Waste Discharge Permit. A State Environmental Policy Act (SEPA) checklist is required. In addition, a Facilities Extension and Grading Permit will be required.

CONSTRUCTION COST ESTIMATE

Table 250S-13 shows construction cost estimates for the working alternative. The cost estimates presented are based on the CSI cost model version 0.6.2. Pipeline costs include import fill of trenches, relocation of existing utilities, dewatering, and pavement restoration throughout the project length. The estimates are conservative and subject to reduction by refinement during predesign. The construction cost estimate for the Stuck River Trunk is approximately $8.9 million.

Table 250S-13. Construction Cost Estimates Stuck River Trunk Working Alternative

Working Alternative	Average Depth (ft)	Quantity	Unit	Estimated Construction Cost [a] (million dollars)
Auburn Planning Zone - Stuck River Trunk				
Pipeline (Open Cut Construction)				
30 inch	18	4,732	LF	$2,520,711
42 inch	21	5,000	LF	$3,690,745
54 inch	25	1,800	LF	$2,247,282
Pipeline (Microtunnel)				
15 inch	15	1	LS	$709,862
		Stuck River Trunk Total		$9,169,000

[a] Cost estimate based on the CSI cost model version 0.6.2 (2001 dollars)

To reduce file size, this figure is now included in a separate .pdf file and is available on the CSI web library

STUCK RIVER TRUNK PLAN AND PROFILE SHEETS

Insert 3 11 x 17 color

Insert sheet 1

Insert Drawing # 0103300-29

Back page for sheet 1

To reduce file size, this figure is now included in a separate .pdf file and is available on the CSI web library

Insert sheet 2

Insert Drawing # 0103300-30

Back page for sheet 2

To reduce file size, this figure is now included in a separate .pdf file and is available on the CSI web library

Insert sheet 3

Insert Drawing #0103300-31

Back page for sheet 3

LAKELAND HILLS REPLACEMENT TRUNK

During the time of this study, King County committed the Lakeland Hills Trunk project to implementation. The project schedule specifies design of the improvements in early 2001.

APPENDIX 250-A

COST ESTIMATE DATA

Cost Calculations for Project: **MCGR CSI 250-S Kent & Auburn**

Project year: 2000

Assumptions

Project Year: 2000

Comments: NOTE: Previous versions of Tabula used to generate original cost estimates utilized a basis year of 2000. A project year of 2001 was chosen resulting in a projected inflation multiplier of one year. Version 0.6.2 now uses a basis year of 1999. In order to maintain a projected inflation multiplier of one year, a project year of 2000 was used. Jan 2000 ENR 7137 and June 2001 is 7329. 7329/7137 = 1.027. Therefore 2.7% is used as a annual projected inflation multiplier.

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
James	Project	2000	0.00	1.00	0.00
36" james	Pipe	2000	3,479,956.08	1.00	3,479,956.08
Microtunnel james	Microtunnel	2000	934,155.81	1.00	934,155.81
Garrison	Project	2000	0.00	1.00	0.00
15" gar	Pipe	2000	816,016.49	1.00	816,016.49
15" (2) gar	Pipe	2000	2,530,745.60	1.00	2,530,745.60
21" gar	Pipe	2000	3,931,233.06	1.00	3,931,233.06
18" gar	Pipe	2000	4,498,008.79	1.00	4,498,008.79
Microtunnel gar	Microtunnel	2000	631,562.11	1.00	631,562.11
26th Street	Project	2000	0.00	1.00	0.00
18" 26th	Pipe	2000	2,148,284.50	1.00	2,148,284.50
Stuck River	Project	2000	0.00	1.00	0.00
30" stuck	Pipe	2000	2,520,711.86	1.00	2,520,711.86
42" stuck	Pipe	2000	3,690,745.57	1.00	3,690,745.57
54" stuck	Pipe	2000	2,247,282.89	1.00	2,247,282.89
Microtunnel stuck	Microtunnel	2000	709,862.97	1.00	709,862.97
Meeker	Project	2000	0.00	1.00	0.00
24" meeker	Pipe	2000	2,568,928.33	1.00	2,568,928.33
SW Auburn	Project	2000	0.00	1.00	0.00
27" sw auburn	Pipe	2000	4,106,716.26	1.00	4,106,716.26

36" sw auburn	Pipe	2000	6,094,833.69	1.00	6,094,833.69
54" sw auburn	Pipe	2000	21,192,820.17	1.00	21,192,820.17
Microtunnel sw auburn	Microtunnel	2000	1,451,939.15	1.00	1,451,939.15
SW Kent	Project	2000	0.00	1.00	0.00
42" sw kent	Pipe	2000	530,037.98	1.00	530,037.98
60" sw kent	Pipe	2000	2,704,969.53	1.00	2,704,969.53
72" sw kent	Pipe	2000	19,189,502.32	1.00	19,189,502.32
78" sw kent	Pipe	2000	17,558,301.04	1.00	17,558,301.04
Microtunnel sw kent	Microtunnel	2000	1,169,645.52	1.00	1,169,645.52
18" siphon sw kent	Pipe	2000	87,233.97	1.00	87,233.97
54" & 42" siphon sw kent	Parallel Pipes	2000	423,914.22	1.00	423,914.22
				Subtotal	105,217,407.90

Total: $105,217,407.90

Cost Calculations for Project: **James**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
36" james	Pipe	2000	3,479,956.08	1.00	3,479,956.08
Microtunnel james	Microtunnel	2000	934,155.81	1.00	934,155.81
				Subtotal	4,414,111.89

Total: $4,414,111.89

Cost Calculations for Pipe: **36" james**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 3900 ft
Conduit Type: Gravity Sewer
Depth of Cover: 33 ft
Trench Backfill Type: Imported
Manhole Spacing: Far (1000 ft)
Existing Utilities: Average
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.667	ft
Trench Width	7.267	ft
Excavation Depth	37.667	ft
Complete Surface Rest. Width	9.267	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	39,536.05	CY	10.00	395,360.49
Backfill	33,588.15	CY	25.00	839,703.70
Complete Pavement Restoration	4,015.56	SY	50.00	200,777.78
Overlay Pavement Restoration	5,517.78	SY	20.00	110,355.56
Trench Safety	293,800.00	SF	0.50	146,900.00
Spoil Load and Haul	39,536.05	CY	10.00	395,360.49
Pipe Unit Material Cost	3,900.00	lf	60.00	234,000.00
Pipe Installation	3,900.00	lf	54.00	210,600.00
Place Pipe Zone Fill	4,422.68	CY	25.00	110,566.93
Manholes	4.00	MH	19,500.00	78,000.00
Existing Utilities	3,900.00	lf	42.00	163,800.00
Dewatering	3,900.00	lf	30.00	117,000.00
Traffic Control	3,900.00	lf	20.00	78,000.00
			Year 1999 subtotal	3,080,424.96

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	3,479,956.08

Total: $3,479,956.08

Cost Calculations for Microtunnel: **Microtunnel james**

Project year: 2000

Assumptions

Construction Year: 2000
Inside Diameter: 36 in.
Length: 200 ft
Dewatering: Significant
Launch Shaft Utilities: Complex
Launch Shaft Excavation Depth: 30 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 30 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Utilities: Complex
Tunnel Easment Length: 0 ft
Easment Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 0
Intermediate Shaft Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	3.66	ft
Spoils Volume	77.932	CY
Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	18	ft
Length	31	ft
Footprint	558	SF
Volume	620	CY

Easment Footprint	5,508	SF

Retrieval Shaft Geometry

Width	22	ft
Length	22	ft
Footprint	484	SF
Volume	537.778	CY
Easment Footprint	5,184	SF

Miscelaneous

Spoils Loads	8	loads

Intermediate Shaft Geometry

Width	18	ft
Length	31	ft
Footprint	558	SF
Volume	620	CY
Easment Footprint	5,508	SF

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Spoils Haul	77.93	CY	25.00	1,948.31
Launch Shaft Excavation	620.00	CY	25.00	15,500.00
Launch Shaft Shoring	2,940.00	SF	57.00	167,580.00
Launch Shaft Utilities	558.00	SF	10.00	5,580.00
Launch Shaft Backfill	620.00	CY	25.00	15,500.00
Launch Shaft Surface Restoration	62.00	SY	50.00	3,100.00
Retrieval Shaft Excavation	537.78	CY	25.00	13,444.44
Retrieval Shaft Shoring	2,640.00	SF	57.00	150,480.00
Retrieval Shaft Utilities	484.00	SF	10.00	4,840.00
Retrieval Shaft Backfill	537.78	CY	25.00	13,444.44
Retrieval Shaft Surface Restoration	53.78	SY	50.00	2,688.89
MTBM Fixed Costs	1.00	LS	150,000.00	150,000.00

Microtunnel Boring	200.00	ft	864.00	172,800.00
Tunnel Dewatering	1.00	LS	60,000.00	60,000.00
Traffic Control	2.00	shaft	25,000.00	50,000.00
			Year 1999 subtotal	826,906.09

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	934,155.81

Total: $934,155.81

Cost Calculations for Project: **Garrison**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
15" gar	Pipe	2000	816,016.49	1.00	816,016.49
15" (2) gar	Pipe	2000	2,530,745.60	1.00	2,530,745.60
21" gar	Pipe	2000	3,931,233.06	1.00	3,931,233.06
18" gar	Pipe	2000	4,498,008.79	1.00	4,498,008.79
Microtunnel gar	Microtunnel	2000	631,562.11	1.00	631,562.11
				Subtotal	12,407,566.05

Total: $12,407,566.05

Cost Calculations for Pipe: **15" gar**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 2000 ft
Conduit Type: Gravity Sewer
Depth of Cover: 16 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Residential Street (14 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 15 in.

Geometry

Outer Diameter	1.667	ft
Trench Width	4.667	ft
Excavation Depth	18.667	ft
Complete Surface Rest. Width	6.667	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	6,452.67	CY	10.00	64,526.75
Backfill	5,185.19	CY	25.00	129,629.63
Complete Pavement Restoration	1,481.48	SY	50.00	74,074.07
Overlay Pavement Restoration	1,629.63	SY	20.00	32,592.59
Trench Safety	74,666.67	SF	0.50	37,333.33
Spoil Load and Haul	6,452.67	CY	10.00	64,526.75

Pipe Unit Material Cost	2,000.00	lf	18.00	36,000.00
Pipe Installation	2,000.00	lf	20.00	40,000.00
Place Pipe Zone Fill	1,105.89	CY	25.00	27,647.13
Manholes	4.00	MH	4,000.00	16,000.00
Existing Utilities	2,000.00	lf	30.00	60,000.00
Dewatering	2,000.00	lf	60.00	120,000.00
Traffic Control	2,000.00	lf	10.00	20,000.00
			Year 1999 subtotal	722,330.26

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	816,016.49

Total: $816,016.49

Cost Calculations for Pipe: **15" (2) gar**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 4800 ft
Conduit Type: Gravity Sewer
Depth of Cover: 21 ft
Trench Backfill Type: Imported
Manhole Spacing: Close (250 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None

Trench Safety: Standard
Pipe Diameter: 15 in.

Geometry

Outer Diameter	1.667	ft
Trench Width	4.667	ft
Excavation Depth	23.667	ft
Complete Surface Rest. Width	6.667	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	19,634.57	CY	10.00	196,345.68
Backfill	16,592.59	CY	25.00	414,814.81
Complete Pavement Restoration	3,555.56	SY	50.00	177,777.78
Overlay Pavement Restoration	8,177.78	SY	20.00	163,555.56
Trench Safety	227,200.00	SF	0.50	113,600.00
Spoil Load and Haul	19,634.57	CY	10.00	196,345.68
Pipe Unit Material Cost	4,800.00	lf	18.00	86,400.00
Pipe Installation	4,800.00	lf	20.00	96,000.00
Place Pipe Zone Fill	2,654.12	CY	25.00	66,353.11
Manholes	20.00	MH	5,250.00	105,000.00
Existing Utilities	4,800.00	lf	60.00	288,000.00
Dewatering	4,800.00	lf	60.00	288,000.00
Traffic Control	4,800.00	lf	10.00	48,000.00
			Year 1999 subtotal	2,240,192.62

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,530,745.60

Total: $2,530,745.60

Cost Calculations for Pipe: **21" gar**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 6380 ft
Conduit Type: Gravity Sewer
Depth of Cover: 23 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 21 in.

Geometry

Outer Diameter	2.208	ft
Trench Width	5.371	ft
Excavation Depth	26.208	ft

Complete Surface Rest. Width 7.371 ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	33,261.21	CY	10.00	332,612.06
Backfill	27,920.38	CY	25.00	698,009.41
Complete Pavement Restoration	5,225.10	SY	50.00	261,255.09
Overlay Pavement Restoration	10,370.45	SY	20.00	207,409.07
Trench Safety	334,418.33	SF	0.50	167,209.17
Spoil Load and Haul	33,261.21	CY	10.00	332,612.06
Pipe Unit Material Cost	6,380.00	lf	26.00	165,880.00
Pipe Installation	6,380.00	lf	27.00	172,260.00
Place Pipe Zone Fill	4,435.77	CY	25.00	110,894.31
Manholes	13.00	MH	5,750.00	74,750.00
Existing Utilities	6,380.00	lf	80.00	510,400.00
Dewatering	6,380.00	lf	60.00	382,800.00
Traffic Control	6,380.00	lf	10.00	63,800.00
			Year 1999 subtotal	3,479,891.18

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	3,931,233.06

Total: $3,931,233.06

Cost Calculations for Pipe: **18" gar**

Project year: 2000

Assumptions

Construction Year: 2000

Length: 7616 ft
Conduit Type: Gravity Sewer
Depth of Cover: 24 ft
Trench Backfill Type: Imported
Manhole Spacing: Close (250 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.917	ft
Trench Width	4.992	ft
Excavation Depth	26.917	ft
Complete Surface Rest. Width	6.992	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	37,899.20	CY	10.00	378,991.98
Backfill	32,384.45	CY	25.00	809,611.36
Complete Pavement Restoration	5,916.50	SY	50.00	295,825.19
Overlay Pavement Restoration	12,700.39	SY	20.00	254,007.70
Trench Safety	409,994.67	SF	0.50	204,997.33
Spoil Load and Haul	37,899.20	CY	10.00	378,991.98
Pipe Unit Material Cost	7,616.00	lf	23.00	175,168.00
Pipe Installation	7,616.00	lf	25.00	190,400.00
Place Pipe Zone Fill	4,700.89	CY	25.00	117,522.26
Manholes	31.00	MH	6,000.00	186,000.00
Existing Utilities	7,616.00	lf	60.00	456,960.00
Dewatering	7,616.00	lf	60.00	456,960.00

Traffic Control	7,616.00	lf	10.00	76,160.00
			Year 1999 subtotal	3,981,595.81

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	4,498,008.79

Total: $4,498,008.79

Cost Calculations for Microtunnel: **Microtunnel gar**

Project year: 2000

Assumptions

Construction Year: 2000
Inside Diameter: 21 in.
Length: 150 ft
Dewatering: Significant
Launch Shaft Utilities: Complex
Launch Shaft Excavation Depth: 22 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 22 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Utilities: Complex
Tunnel Easment Length: 0 ft
Easment Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 0
Intermediate Shaft Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	2.2	ft
Spoils Volume	21.118	CY
Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	17	ft
Length	30	ft
Footprint	510	SF
Volume	415.556	CY
Easment Footprint	5,360	SF

Retrieval Shaft Geometry

Width	21	ft
Length	21	ft
Footprint	441	SF
Volume	359.333	CY
Easment Footprint	5,041	SF

Miscelaneous

Spoils Loads	3	loads

Intermediate Shaft Geometry

Width	17	ft
Length	30	ft
Footprint	510	SF
Volume	415.556	CY
Easment Footprint	5,360	SF

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Spoils Haul	21.12	CY	25.00	527.96
Launch Shaft Excavation	415.56	CY	25.00	10,388.89

Launch Shaft Shoring	2,068.00	SF	44.20	91,405.60
Launch Shaft Utilities	510.00	SF	10.00	5,100.00
Launch Shaft Backfill	415.56	CY	25.00	10,388.89
Launch Shaft Surface Restoration	56.67	SY	50.00	2,833.33
Retrieval Shaft Excavation	359.33	CY	25.00	8,983.33
Retrieval Shaft Shoring	1,848.00	SF	44.20	81,681.60
Retrieval Shaft Utilities	441.00	SF	10.00	4,410.00
Retrieval Shaft Backfill	359.33	CY	25.00	8,983.33
Retrieval Shaft Surface Restoration	49.00	SY	50.00	2,450.00
MTBM Fixed Costs	1.00	LS	140,000.00	140,000.00
Microtunnel Boring	150.00	ft	546.00	81,900.00
Tunnel Dewatering	1.00	LS	60,000.00	60,000.00
Traffic Control	2.00	shaft	25,000.00	50,000.00
			Year 1999 subtotal	559,052.94

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	631,562.11

Total: $631,562.11

Cost Calculations for Project: **26th Street**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
18" 26th	Pipe	2000	2,148,284.50	1.00	2,148,284.50
				Subtotal	2,148,284.50

Total: $2,148,284.50

Cost Calculations for Pipe: **18" 26th**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 4900 ft
Conduit Type: Gravity Sewer
Depth of Cover: 16 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Light
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.917	ft
Trench Width	4.992	ft
Excavation Depth	18.917	ft
Complete Surface Rest. Width	6.992	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	17,136.51	CY	10.00	171,365.15
Backfill	13,588.43	CY	25.00	339,710.65
Complete Pavement Restoration	3,806.57	SY	50.00	190,328.70
Overlay Pavement Restoration	5,993.43	SY	20.00	119,868.52
Trench Safety	185,383.33	SF	0.50	92,691.67
Spoil Load and Haul	17,136.51	CY	10.00	171,365.15
Pipe Unit Material Cost	4,900.00	lf	23.00	112,700.00
Pipe Installation	4,900.00	lf	25.00	122,500.00
Place Pipe Zone Fill	3,024.47	CY	25.00	75,611.75
Manholes	10.00	MH	4,000.00	40,000.00
Existing Utilities	4,900.00	lf	30.00	147,000.00
Dewatering	4,900.00	lf	60.00	294,000.00
Traffic Control	4,900.00	lf	5.00	24,500.00
			Year 1999 subtotal	1,901,641.59

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,148,284.50

Total: $2,148,284.50

Cost Calculations for Project: **Stuck River**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
30" stuck	Pipe	2000	2,520,711.86	1.00	2,520,711.86
42" stuck	Pipe	2000	3,690,745.57	1.00	3,690,745.57
54" stuck	Pipe	2000	2,247,282.89	1.00	2,247,282.89
Microtunnel stuck	Microtunnel	2000	709,862.97	1.00	709,862.97
				Subtotal	9,168,603.30

Total: $9,168,603.30

Cost Calculations for Pipe: **30" stuck**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 4700 ft
Conduit Type: Gravity Sewer
Depth of Cover: 18 ft
Trench Backfill Type: Imported
Manhole Spacing: Far (1000 ft)
Existing Utilities: Average
Dewatering: Minimal
Pavement Restoration: Trench Width
Traffic: Light
Right of Way: None
Required Easments: None

Trench Safety: Standard
Pipe Diameter: 30 in.

Geometry

Outer Diameter	3.083	ft
Trench Width	6.508	ft
Excavation Depth	22.083	ft
Complete Surface Rest. Width	8.508	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	25,018.92	CY	10.00	250,189.17
Backfill	19,259.85	CY	25.00	481,496.14
Complete Pavement Restoration	4,443.24	SY	50.00	222,162.04
Trench Safety	207,583.33	SF	0.50	103,791.67
Spoil Load and Haul	25,018.92	CY	10.00	250,189.17
Pipe Unit Material Cost	4,700.00	lf	50.00	235,000.00
Pipe Installation	4,700.00	lf	40.00	188,000.00
Place Pipe Zone Fill	4,459.31	CY	25.00	111,482.66
Manholes	5.00	MH	12,000.00	60,000.00
Existing Utilities	4,700.00	lf	40.00	188,000.00
Dewatering	4,700.00	lf	20.00	94,000.00
Traffic Control	4,700.00	lf	10.00	47,000.00
			Year 1999 subtotal	2,231,310.84

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,520,711.86

Total: $2,520,711.86

Cost Calculations for Pipe: **42" stuck**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 5000 ft
Conduit Type: Gravity Sewer
Depth of Cover: 21 ft
Trench Backfill Type: Imported
Manhole Spacing: Far (1000 ft)
Existing Utilities: Average
Dewatering: Minimal
Pavement Restoration: Trench Width
Traffic: Light
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 42 in.

Geometry

Outer Diameter	4.25	ft
Trench Width	8.025	ft
Excavation Depth	26.25	ft
Complete Surface Rest. Width	10.025	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	39,010.42	CY	10.00	390,104.17
Backfill	29,722.22	CY	25.00	743,055.56
Complete Pavement Restoration	5,569.44	SY	50.00	278,472.22
Trench Safety	262,500.00	SF	0.50	131,250.00
Spoil Load and Haul	39,010.42	CY	10.00	390,104.17
Pipe Unit Material Cost	5,000.00	lf	78.00	390,000.00

Pipe Installation	5,000.00	lf	60.00	300,000.00
Place Pipe Zone Fill	6,661.11	CY	25.00	166,527.76
Manholes	5.00	MH	13,500.00	67,500.00
Existing Utilities	5,000.00	lf	42.00	210,000.00
Dewatering	5,000.00	lf	30.00	150,000.00
Traffic Control	5,000.00	lf	10.00	50,000.00
			Year 1999 subtotal	3,267,013.87

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	3,690,745.57

Total: $3,690,745.57

Cost Calculations for Pipe: **54" stuck**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 1800 ft
Conduit Type: Gravity Sewer
Depth of Cover: 25 ft
Trench Backfill Type: Imported
Manhole Spacing: Far (1000 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Trench Width
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard

Pipe Diameter: 54 in.

Geometry

Outer Diameter	5.542	ft
Trench Width	9.704	ft
Excavation Depth	31.542	ft
Complete Surface Rest. Width	11.704	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	20,405.71	CY	10.00	204,057.06
Backfill	15,526.67	CY	25.00	388,166.67
Complete Pavement Restoration	2,340.83	SY	50.00	117,041.67
Trench Safety	113,550.00	SF	0.50	56,775.00
Spoil Load and Haul	20,405.71	CY	10.00	204,057.06
Pipe Unit Material Cost	1,800.00	lf	150.00	270,000.00
Pipe Installation	1,800.00	lf	100.00	180,000.00
Place Pipe Zone Fill	3,271.06	CY	25.00	81,776.60
Manholes	2.00	MH	27,700.00	55,400.00
Existing Utilities	1,800.00	lf	120.00	216,000.00
Dewatering	1,800.00	lf	90.00	162,000.00
Traffic Control	1,800.00	lf	30.00	54,000.00
			Year 1999 subtotal	1,989,274.05

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,247,282.89

Total: $2,247,282.89

Cost Calculations for Microtunnel: **Microtunnel stuck**

Project year: 2000

Assumptions

Construction Year: 2000
Inside Diameter: 15 in.
Length: 800 ft
Dewatering: Minimal
Launch Shaft Utilities: Average
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Hydroseed
Retrieval Shaft Excavation Depth: 15 ft
Retrieval Shaft Surface Restoration: Hydroseed
Retrieval Shaft Utilities: Average
Tunnel Easment Length: 0 ft
Easment Type: None
Traffic: Standard
Casing Required: false
Number of Intermediate Shafts: 0
Intermediate Shaft Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	1.66	ft
Spoils Volume	64.126	CY
Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	17	ft
Length	30	ft
Footprint	510	SF
Volume	283.333	CY

Easment Footprint	2,820	SF

Retrieval Shaft Geometry

Width	21	ft
Length	21	ft
Footprint	441	SF
Volume	245	CY
Easment Footprint	2,601	SF

Miscelaneous

Spoils Loads	7	loads

Intermediate Shaft Geometry

Width	17	ft
Length	30	ft
Footprint	510	SF
Volume	283.333	CY
Easment Footprint	2,820	SF

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Spoils Haul	64.13	CY	25.00	1,603.14
Launch Shaft Excavation	283.33	CY	25.00	7,083.33
Launch Shaft Shoring	1,410.00	SF	33.00	46,530.00
Launch Shaft Utilities	510.00	SF	6.00	3,060.00
Launch Shaft Backfill	283.33	CY	25.00	7,083.33
Launch Shaft Surface Restoration	56.67	SY	5.00	283.33
Retrieval Shaft Excavation	245.00	CY	25.00	6,125.00
Retrieval Shaft Shoring	1,260.00	SF	33.00	41,580.00
Retrieval Shaft Utilities	441.00	SF	6.00	2,646.00
Retrieval Shaft Backfill	245.00	CY	25.00	6,125.00
Retrieval Shaft Surface Restoration	49.00	SY	5.00	245.00
MTBM Fixed Costs	1.00	LS	100,000.00	100,000.00

Microtunnel Boring	800.00	ft	420.00	336,000.00
Tunnel Dewatering	1.00	LS	40,000.00	40,000.00
Traffic Control	2.00	shaft	15,000.00	30,000.00
			Year 1999 subtotal	628,364.14

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	709,862.97

Total: $709,862.97

Cost Calculations for Project: **Meeker**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
24" meeker	Pipe	2000	2,568,928.33	1.00	2,568,928.33
				Subtotal	2,568,928.33

Total: $2,568,928.33

Cost Calculations for Pipe: **24" meeker**

Project year: 2000

Assumptions

Construction Year: 2000

Length: 4379 ft
Conduit Type: Gravity Sewer
Depth of Cover: 16 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 24 in.

Geometry

Outer Diameter	2.5	ft
Trench Width	5.75	ft
Excavation Depth	19.5	ft
Complete Surface Rest. Width	7.75	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	18,185.01	CY	10.00	181,850.14
Backfill	13,988.47	CY	25.00	349,711.81
Complete Pavement Restoration	3,770.81	SY	50.00	188,540.28
Overlay Pavement Restoration	6,933.42	SY	20.00	138,668.33
Trench Safety	170,781.00	SF	0.50	85,390.50
Spoil Load and Haul	18,185.01	CY	10.00	181,850.14
Pipe Unit Material Cost	4,379.00	lf	30.00	131,370.00
Pipe Installation	4,379.00	lf	30.00	131,370.00
Place Pipe Zone Fill	3,400.42	CY	25.00	85,010.43
Manholes	9.00	MH	6,200.00	55,800.00
Existing Utilities	4,379.00	lf	80.00	350,320.00
Dewatering	4,379.00	lf	70.00	306,530.00

Traffic Control	4,379.00	lf	20.00	87,580.00
			Year 1999 subtotal	2,273,991.62

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,568,928.33

Total: $2,568,928.33

Cost Calculations for Project: **SW Auburn**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
27" sw auburn	Pipe	2000	4,106,716.26	1.00	4,106,716.26
36" sw auburn	Pipe	2000	6,094,833.69	1.00	6,094,833.69
54" sw auburn	Pipe	2000	21,192,820.17	1.00	21,192,820.17
Microtunnel sw auburn	Microtunnel	2000	1,451,939.15	1.00	1,451,939.15
				Subtotal	32,846,309.27

Total: $32,846,309.27

Cost Calculations for Pipe: **27" sw auburn**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 7000 ft
Conduit Type: Gravity Sewer
Depth of Cover: 18 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 27 in.

Geometry

Outer Diameter	2.792	ft
Trench Width	6.129	ft
Excavation Depth	21.792	ft
Complete Surface Rest. Width	8.129	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	34,627.90	CY	10.00	346,279.00
Backfill	27,013.73	CY	25.00	675,343.36
Complete Pavement Restoration	6,322.69	SY	50.00	316,134.26
Overlay Pavement Restoration	10,788.43	SY	20.00	215,768.52
Trench Safety	305,083.33	SF	0.50	152,541.67
Spoil Load and Haul	34,627.90	CY	10.00	346,279.00
Pipe Unit Material Cost	7,000.00	lf	36.00	252,000.00
Pipe Installation	7,000.00	lf	35.00	245,000.00
Place Pipe Zone Fill	6,027.26	CY	25.00	150,681.48
Manholes	14.00	MH	6,800.00	95,200.00
Existing Utilities	7,000.00	lf	80.00	560,000.00

Dewatering	7,000.00	lf	20.00	140,000.00
Traffic Control	7,000.00	lf	20.00	140,000.00
			Year 1999 subtotal	3,635,227.29

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	4,106,716.26

Total: $4,106,716.26

Cost Calculations for Pipe: **36" sw auburn**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 7724 ft
Conduit Type: Gravity Sewer
Depth of Cover: 21 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.667	ft
Trench Width	7.267	ft
Excavation Depth	25.667	ft
Complete Surface Rest. Width	9.267	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	53,355.99	CY	10.00	533,559.93
Backfill	41,576.10	CY	25.00	1,039,402.47
Complete Pavement Restoration	7,952.86	SY	50.00	397,642.96
Overlay Pavement Restoration	10,928.03	SY	20.00	218,560.59
Trench Safety	396,498.67	SF	0.50	198,249.33
Spoil Load and Haul	53,355.99	CY	10.00	533,559.93
Pipe Unit Material Cost	7,724.00	lf	60.00	463,440.00
Pipe Installation	7,724.00	lf	54.00	417,096.00
Place Pipe Zone Fill	8,759.17	CY	25.00	218,979.23
Manholes	16.00	MH	13,500.00	216,000.00
Existing Utilities	7,724.00	lf	100.00	772,400.00
Dewatering	7,724.00	lf	30.00	231,720.00
Traffic Control	7,724.00	lf	20.00	154,480.00
			Year 1999 subtotal	5,395,090.46

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	6,094,833.69

Total: $6,094,833.69

Cost Calculations for Pipe: **54" sw auburn**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 18448 ft
Conduit Type: Gravity Sewer
Depth of Cover: 21 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 54 in.

Geometry

Outer Diameter	5.542	ft
Trench Width	9.704	ft
Excavation Depth	27.542	ft
Complete Surface Rest. Width	11.704	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	182,613.97	CY	10.00	1,826,139.67
Backfill	132,609.23	CY	25.00	3,315,230.86
Complete Pavement Restoration	23,990.94	SY	50.00	1,199,547.04
Overlay Pavement Restoration	21,104.17	SY	20.00	422,083.41
Trench Safety	1,016,177.33	SF	0.50	508,088.67
Spoil Load and Haul	182,613.97	CY	10.00	1,826,139.67
Pipe Unit Material Cost	18,448.00	lf	150.00	2,767,200.00
Pipe Installation	18,448.00	lf	100.00	1,844,800.00
Place Pipe Zone Fill	33,524.77	CY	25.00	838,119.26
Manholes	37.00	MH	24,100.00	891,700.00

Existing Utilities	18,448.00	lf	120.00	2,213,760.00
Dewatering	18,448.00	lf	30.00	553,440.00
Traffic Control	18,448.00	lf	30.00	553,440.00
			Year 1999 subtotal	18,759,688.57

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	21,192,820.17

Total: $21,192,820.17

Cost Calculations for Microtunnel: **Microtunnel sw auburn**

Project year: 2000

Assumptions

Construction Year: 2000
Inside Diameter: 54 in.
Length: 500 ft
Dewatering: Minimal
Launch Shaft Utilities: Complex
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 20 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Utilities: Complex
Tunnel Easment Length: 0 ft
Easment Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 0
Intermediate Shaft Utilities: Average

Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	5.54	ft
Spoils Volume	446.391	CY
Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	366.667	CY
Easment Footprint	3,150	SF

Retrieval Shaft Geometry

Width	24	ft
Length	24	ft
Footprint	576	SF
Volume	426.667	CY
Easment Footprint	2,916	SF

Miscelaneous

Spoils Loads	45	loads

Intermediate Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	366.667	CY
Easment Footprint	3,150	SF

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Spoils Haul	446.39	CY	25.00	11,159.78
Launch Shaft Excavation	366.67	CY	25.00	9,166.67
Launch Shaft Shoring	1,590.00	SF	33.00	52,470.00
Launch Shaft Utilities	660.00	SF	10.00	6,600.00
Launch Shaft Backfill	366.67	CY	25.00	9,166.67
Launch Shaft Surface Restoration	73.33	SY	50.00	3,666.67
Retrieval Shaft Excavation	426.67	CY	25.00	10,666.67
Retrieval Shaft Shoring	1,920.00	SF	41.00	78,720.00
Retrieval Shaft Utilities	576.00	SF	10.00	5,760.00
Retrieval Shaft Backfill	426.67	CY	25.00	10,666.67
Retrieval Shaft Surface Restoration	64.00	SY	50.00	3,200.00
MTBM Fixed Costs	1.00	LS	400,000.00	400,000.00
Microtunnel Boring	500.00	ft	1,188.00	594,000.00
Tunnel Dewatering	1.00	LS	40,000.00	40,000.00
Traffic Control	2.00	shaft	25,000.00	50,000.00
			Year 1999 subtotal	1,285,243.11

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	1,451,939.15

Total: $1,451,939.15

Cost Calculations for Project: **SW Kent**

Project year: 2000

Assumptions

Project Year: 2000
Comments:

Sub Items

Name	Type	Year	Cost	Multiplier	2000 Cost
42" sw kent	Pipe	2000	530,037.98	1.00	530,037.98
60" sw kent	Pipe	2000	2,704,969.53	1.00	2,704,969.53
72" sw kent	Pipe	2000	19,189,502.32	1.00	19,189,502.32
78" sw kent	Pipe	2000	17,558,301.04	1.00	17,558,301.04
Microtunnel sw kent	Microtunnel	2000	1,169,645.52	1.00	1,169,645.52
18" siphon sw kent	Pipe	2000	87,233.97	1.00	87,233.97
54" & 42" siphon sw kent	Parallel Pipes	2000	423,914.22	1.00	423,914.22
				Subtotal	41,663,604.57

Total: $41,663,604.57

Cost Calculations for Pipe: **42" sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 700 ft
Conduit Type: Gravity Sewer
Depth of Cover: 15 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)

Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 42 in.

Geometry

Outer Diameter	4.25	ft
Trench Width	8.025	ft
Excavation Depth	20.25	ft
Complete Surface Rest. Width	10.025	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	4,213.12	CY	10.00	42,131.25
Backfill	2,912.78	CY	25.00	72,819.44
Complete Pavement Restoration	779.72	SY	50.00	38,986.11
Overlay Pavement Restoration	931.39	SY	20.00	18,627.78
Trench Safety	28,350.00	SF	0.50	14,175.00
Spoil Load and Haul	4,213.12	CY	10.00	42,131.25
Pipe Unit Material Cost	700.00	lf	78.00	54,600.00
Pipe Installation	700.00	lf	60.00	42,000.00
Place Pipe Zone Fill	932.56	CY	25.00	23,313.89
Manholes	2.00	MH	10,500.00	21,000.00
Existing Utilities	700.00	lf	42.00	29,400.00
Dewatering	700.00	lf	80.00	56,000.00
Traffic Control	700.00	lf	20.00	14,000.00
			Year 1999 subtotal	469,184.72

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	530,037.98

Total: $530,037.98

Cost Calculations for Pipe: **60" sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 2500 ft
Conduit Type: Gravity Sewer
Depth of Cover: 12 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 60 in.

Geometry

Outer Diameter	6.125	ft
Trench Width	10.462	ft
Excavation Depth	19.125	ft
Complete Surface Rest. Width	12.462	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	18,527.34	CY	10.00	185,273.44
Backfill	10,656.25	CY	25.00	266,406.25
Complete Pavement Restoration	3,461.81	SY	50.00	173,090.28
Overlay Pavement Restoration	2,649.31	SY	20.00	52,986.11
Trench Safety	95,625.00	SF	0.50	47,812.50
Spoil Load and Haul	18,527.34	CY	10.00	185,273.44
Pipe Unit Material Cost	2,500.00	lf	190.00	475,000.00
Pipe Installation	2,500.00	lf	120.00	300,000.00
Place Pipe Zone Fill	5,142.88	CY	25.00	128,572.01
Manholes	5.00	MH	16,000.00	80,000.00
Existing Utilities	2,500.00	lf	80.00	200,000.00
Dewatering	2,500.00	lf	90.00	225,000.00
Traffic Control	2,500.00	lf	30.00	75,000.00
			Year 1999 subtotal	2,394,414.03

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	2,704,969.53

Total: $2,704,969.53

Cost Calculations for Pipe: **72" sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 11910 ft
Conduit Type: Gravity Sewer

Depth of Cover: 19 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 72 in.

Geometry

Outer Diameter	7.292	ft
Trench Width	11.979	ft
Excavation Depth	27.292	ft
Complete Surface Rest. Width	13.979	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	144,213.08	CY	10.00	1,442,130.84
Backfill	95,114.58	CY	25.00	2,377,864.58
Complete Pavement Restoration	18,499.10	SY	50.00	924,954.86
Overlay Pavement Restoration	10,614.24	SY	20.00	212,284.72
Trench Safety	650,087.50	SF	0.50	325,043.75
Spoil Load and Haul	144,213.08	CY	10.00	1,442,130.84
Pipe Unit Material Cost	11,910.00	lf	240.00	2,858,400.00
Pipe Installation	11,910.00	lf	160.00	1,905,600.00
Place Pipe Zone Fill	30,678.42	CY	25.00	766,960.53
Manholes	24.00	MH	28,400.00	681,600.00
Existing Utilities	11,910.00	lf	200.00	2,382,000.00
Dewatering	11,910.00	lf	100.00	1,191,000.00
Traffic Control	11,910.00	lf	40.00	476,400.00
			Year 1999 subtotal	16,986,370.11

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	19,189,502.32

Total: $19,189,502.32

Cost Calculations for Pipe: **78" sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 9360 ft
Conduit Type: Gravity Sewer
Depth of Cover: 23 ft
Trench Backfill Type: Imported
Manhole Spacing: Average (500 ft)
Existing Utilities: Complex
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Heavy
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 78 in.

Geometry

Outer Diameter	8	ft
Trench Width	12.9	ft
Excavation Depth	32	ft
Complete Surface Rest. Width	14.9	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	143,104.00	CY	10.00	1,431,040.00
Backfill	98,384.00	CY	25.00	2,459,600.00
Complete Pavement Restoration	15,496.00	SY	50.00	774,800.00
Overlay Pavement Restoration	7,384.00	SY	20.00	147,680.00
Trench Safety	599,040.00	SF	0.50	299,520.00
Spoil Load and Haul	143,104.00	CY	10.00	1,431,040.00
Pipe Unit Material Cost	9,360.00	lf	280.00	2,620,800.00
Pipe Installation	9,360.00	lf	180.00	1,684,800.00
Place Pipe Zone Fill	27,294.63	CY	25.00	682,365.82
Manholes	19.00	MH	43,600.00	828,400.00
Existing Utilities	9,360.00	lf	200.00	1,872,000.00
Dewatering	9,360.00	lf	100.00	936,000.00
Traffic Control	9,360.00	lf	40.00	374,400.00
			Year 1999 subtotal	15,542,445.82

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	17,558,301.04

Total: $17,558,301.04

Cost Calculations for Microtunnel: **Microtunnel sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Inside Diameter: 60 in.
Length: 250 ft

Dewatering: Significant
Launch Shaft Utilities: Complex
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Pavement
Retrieval Shaft Excavation Depth: 15 ft
Retrieval Shaft Surface Restoration: Pavement
Retrieval Shaft Utilities: Complex
Tunnel Easment Length: 0 ft
Easment Type: None
Traffic: Heavy
Casing Required: false
Number of Intermediate Shafts: 0
Intermediate Shaft Utilities: Average
Intermediate Shaft Excavation Depth: 40 ft
Intermediate Shaft Surface Restoration: Hydroseed

Tunnel Geometry

Outer Diameter	6.12	ft
Spoils Volume	272.376	CY
Casing Pipe Diameter	N/A	in

Launch Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	366.667	CY
Easment Footprint	3,150	SF

Retrieval Shaft Geometry

Width	24	ft
Length	24	ft
Footprint	576	SF
Volume	320	CY
Easment Footprint	2,916	SF

Miscelaneous

Spoils Loads 28 loads

Intermediate Shaft Geometry

Width	20	ft
Length	33	ft
Footprint	660	SF
Volume	366.667	CY
Easment Footprint	3,150	SF

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Spoils Haul	272.38	CY	25.00	6,809.40
Launch Shaft Excavation	366.67	CY	25.00	9,166.67
Launch Shaft Shoring	1,590.00	SF	33.00	52,470.00
Launch Shaft Utilities	660.00	SF	10.00	6,600.00
Launch Shaft Backfill	366.67	CY	25.00	9,166.67
Launch Shaft Surface Restoration	73.33	SY	50.00	3,666.67
Retrieval Shaft Excavation	320.00	CY	25.00	8,000.00
Retrieval Shaft Shoring	1,440.00	SF	33.00	47,520.00
Retrieval Shaft Utilities	576.00	SF	10.00	5,760.00
Retrieval Shaft Backfill	320.00	CY	25.00	8,000.00
Retrieval Shaft Surface Restoration	64.00	SY	50.00	3,200.00
MTBM Fixed Costs	1.00	LS	450,000.00	450,000.00
Microtunnel Boring	250.00	ft	1,260.00	315,000.00
Tunnel Dewatering	1.00	LS	60,000.00	60,000.00
Traffic Control	2.00	shaft	25,000.00	50,000.00
			Year 1999 subtotal	1,035,359.40

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	1,169,645.52

Total: $1,169,645.52

Cost Calculations for Pipe: **18" siphon sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 200 ft
Conduit Type: Gravity Sewer
Depth of Cover: 20 ft
Trench Backfill Type: Imported
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Minimal
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Light
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.917	ft
Trench Width	4.992	ft
Excavation Depth	22.917	ft
Complete Surface Rest. Width	6.992	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	847.35	CY	10.00	8,473.51
Backfill	702.53	CY	25.00	17,563.27
Complete Pavement Restoration	155.37	SY	50.00	7,768.52
Overlay Pavement Restoration	333.52	SY	20.00	6,670.37
Trench Safety	9,166.67	SF	0.50	4,583.33
Spoil Load and Haul	847.35	CY	10.00	8,473.51
Pipe Unit Material Cost	200.00	lf	23.00	4,600.00
Pipe Installation	200.00	lf	25.00	5,000.00
Place Pipe Zone Fill	123.45	CY	25.00	3,086.19
Existing Utilities	200.00	lf	30.00	6,000.00
Dewatering	200.00	lf	20.00	4,000.00
Traffic Control	200.00	lf	5.00	1,000.00
			Year 1999 subtotal	77,218.70

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	87,233.97

Total: $87,233.97

Cost Calculations for Parallel Pipes: **54" & 42" siphon sw kent**

Project year: 2000

Assumptions

Construction Year: 2000
Length: 200 ft
Conduit Type: Gravity Sewer
Depth of Cover: 20 ft

Trench Backfill Type: Imported
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Arterial (22 ft)
Traffic: Light
Right of Way: None
Required Easments: None
Trench Safety: Standard
Pipe One Diameter: 54 in.
Pipe Two Diameter: 42 in.

Geometry

Outer Diameter 1	5.542	ft
Outer Diameter 2	4.25	ft
Trench Width	16.326	ft
Excavation Depth	26.542	ft
Complete Surface Rest. Width	18.326	ft

Unit Costs (Basis 1999)

Item	Quantity	Unit	Unit Cost	ItemCost
Excavation	3,209.68	CY	10.00	32,096.78
Backfill	2,297.67	CY	25.00	57,441.65
Complete Pavement Restoration	407.23	SY	50.00	20,361.69
Overlay Pavement Restoration	81.66	SY	20.00	1,633.10
Trench Safety	10,616.67	SF	0.50	5,308.33
Spoil Load and Haul	3,209.68	CY	10.00	32,096.78
Pipe Unit Material Cost	200.00	lf	228.00	45,600.00
Pipe Installation	200.00	lf	160.00	32,000.00
Place Pipe Zone Fill	628.26	CY	25.00	15,706.62
Existing Utilities	200.00	lf	60.00	12,000.00
Dewatering	200.00	lf	90.00	18,000.00
Traffic Control	200.00	lf	15.00	3,000.00
structures	1.00	LS	100,000.00	100,000.00

Year 1999 subtotal	375,244.95

Mobilization/Demobilization at 10%	1.10
Projected Inflation Multiplier from 1999 to 2000 at 2.7%	1.03
Effective Multiplier	1.13
Subtotal	423,914.22

Total: $423,914.22